Power Supplies
WBS 2.3

George Krafczyk

Overview

- WBS 2.3.1 – 30 Volt/10,000 Amp Power Supplies
  - Three supplies needed
- WBS 2.3.3 – 10 Volt/5,000 Amp Power Supplies
  - Four supplies needed
- Both projects will be assigned to a single Electrical Engineer to manage, design, oversee construction and installation/commissioning.
- The main features common to both types of the supplies are:
  - 12 Pulse SCR supply
  - Passive Filter
  - Use Fermi Voltage and Current Regulators
  - 10 PPM Current Regulation
  - Integrated Quench Protection Circuitry
  - Accentuated Tevatron Reliability

Overview (Continue)

- WBS 2.3.5 – Q2 Shunts – 10 Volts/200 Amps
  - Shunts will be FET elements that are driven in current mode.
  - They will need to feed information to the quench protection module for these magnet loads.
  - The shunt current will be unipolar.

- WBS 2.3.8 – 20 Volt/50 Amp Correction Element Power Supplies
  - Thirteen supplies needed.
  - Supplies will be located in the C0 Service Building.
  - We are proposing the existing 50 Amp Four Quadrant Switcher used in the Main Injector with a reduced Raw Power Supply.
  - The Quench Protection will be handled external to the switcher module.

Magnet Circuits

B4-Service Building

Circuit	Magnet	Power	Volt	Current
C:QB45	B45-"Q1"	50 KW	10 V	5,000 A
C:QB46	B46-"Q1"	50 KW	10 V	5,000 A

C0-Service Building

Circuit	Magnet	Power	Volt	Current
C:C0Q5	B47-Q5, C13-Q5	300 KW	30 V	10,000 A
C:C0Q4	B48-Q4, C12-Q4	300 KW	30 V	10,000 A
C:C0Q123	B49-Q1, Q2, Q3 C11-Q1, Q2, Q3	300 KW	30 V	10,000 A
C:C0QT2u	B49-Q2		10 V	200 A
C:C0QT2d	C11-Q2		10 V	200 A

C1-Service Building

Circuit	Magnet	Power	Volt	Current
C:QC14	C14-"Q1"	50 KW	10 V	5,000 A
C:QC15	C15-"Q1"	50 KW	10 V	5,000 A

Circuit Parameters

B4-Service Building

Circuit	Ind [Henries]	dI/dT [Amps/sec]	L*dI/dT [Volts]	Bus *l* [feet]	I*R [Volts]	PS V [Volts]
C:QB45	0.01075	70	0.8	100	3.3	4.1
C:QB46	0.01075	70	0.8	218	6.0	6.8

Circuit	Ind [Henries]	dI/dT [Amps/sec]	L*dI/dT [Volts]	Bus *l* [feet]	I*R [Volts]	PS V [Volts]
C:C0Q5	0.0085	155	1.3	780	18.9	20.3
C:C0Q4	0.0124	155	1.9	642	15.8	17.7
C:C0Q123	0.0573	155	8.9	370	9.5	18.4

Circuit	Ind [Henries]	dI/dT [Amps/sec]	L*dI/dT [Volts]	Bus *l* [feet]	I*R [Volts]	PS V [Volts]
C:QC14	0.01075	70	0.8	218	6.0	6.8
C:QC15	0.01075	70	0.8	100	3.3	4.1

Power Supplies

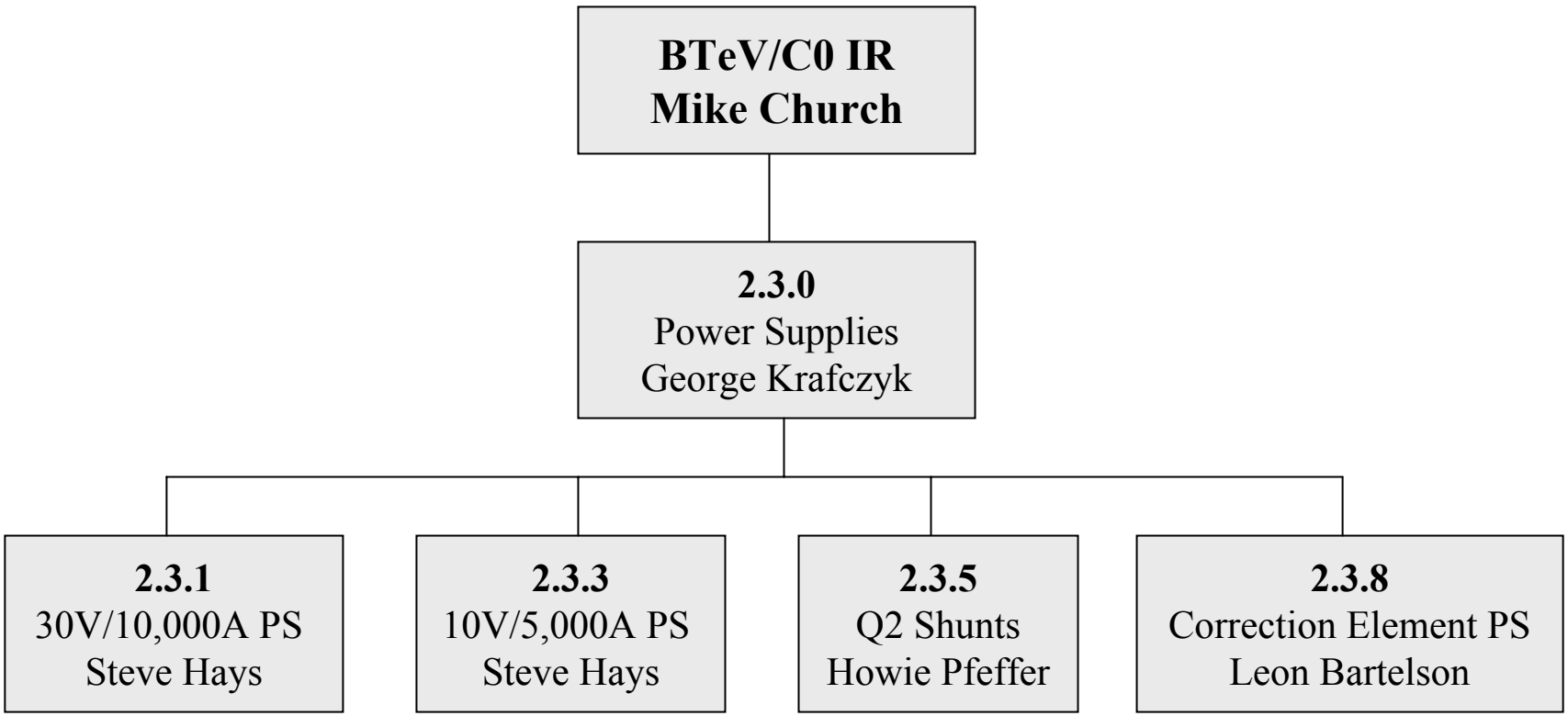
D0 - 10 PPM Current regulation system. DCCT's have a mini cooler to do the temperature regulation of the burden resistor. Thermal electric coolers would be used today to get equivalent stability with less maintenance.

Spang Supplies built under the contract that required the use of Fermi's Voltage and Current Regulators.

Power Supplies – Correction Element

Main Injector
Correction Element
Installation at MI_10
Service Building

Organization and Management

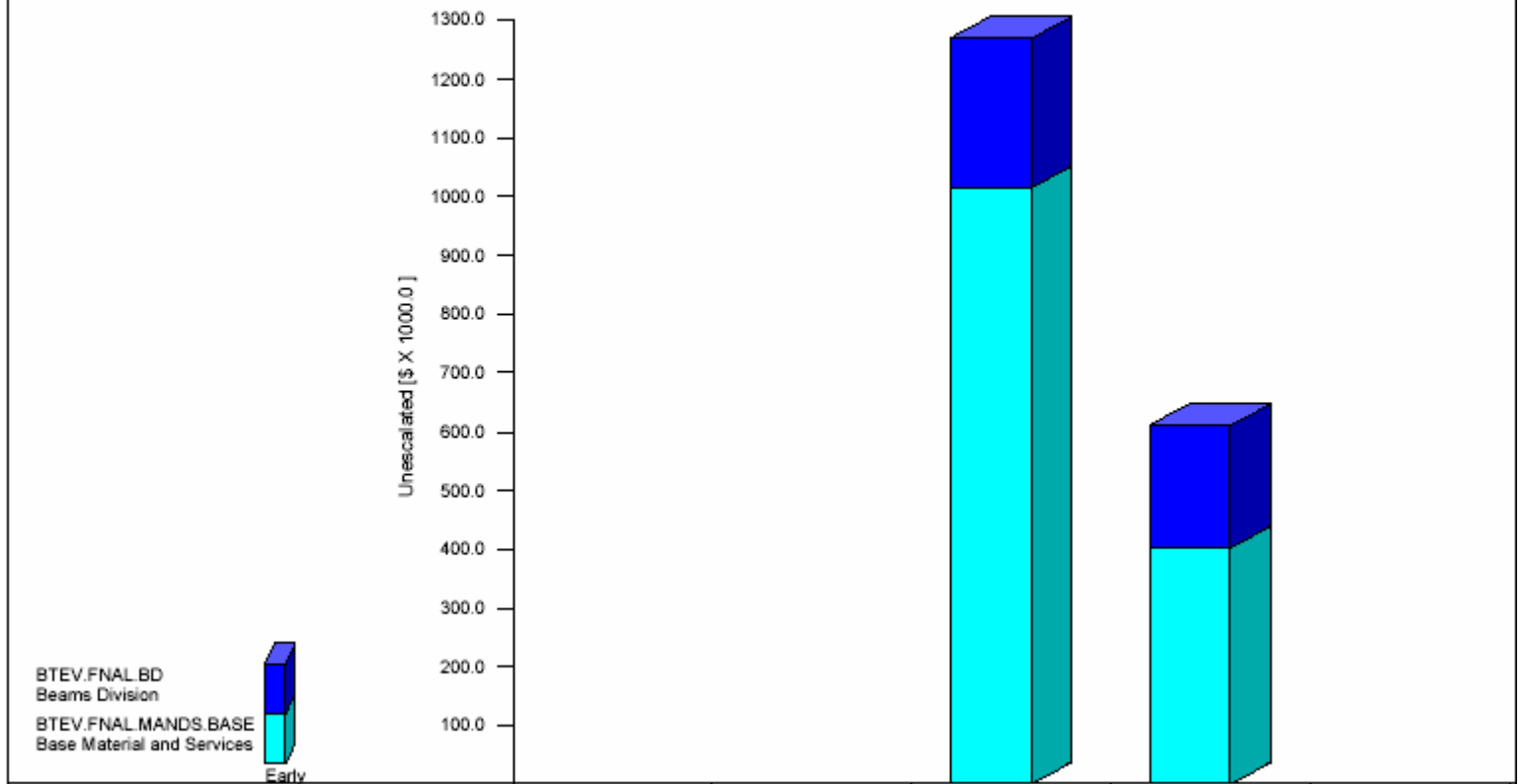


Construction Cost Breakdown WBS 2.3

WBS	Subproject	M&S (K$)	labor (K$)	total (K$)
2.3.1	10 kA supplies @ C0	703.6	156.2	859.8
2.3.3	5 kA supplies @ B4, C1	604.1	157.7	761.8
2.3.5	Q2 shunts	65.0	105.8	170.8
2.3.8	corrector PS's	42.9	73.2	116.1
	Total	**1415.6**	**492.9**	**1908.5**

Total Obligation Profile by Fiscal Year WBS 2.3

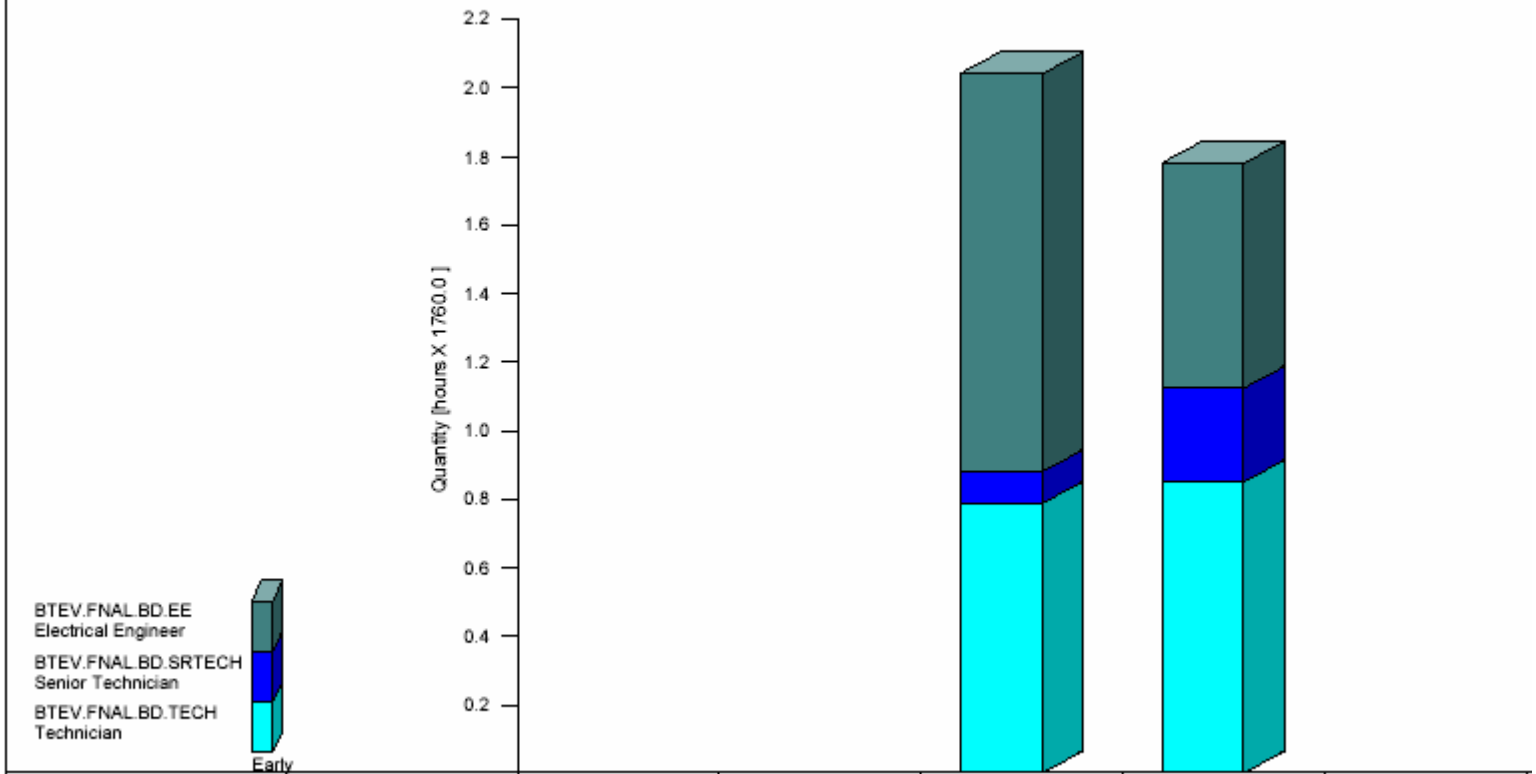
Activity ID	Activity Description	FY05	FY06	FY07	FY08	FY09
3	Power supplies			3		



BTEV.FNAL.MANDS.BASE : Base Material and Services	0.0	0.0	1013.9	401.7	0.0
BTEV.FNAL.BD : Beams Division	0.0	0.0	254.0	206.4	0.0

Labor Profile by Fiscal Year (FTE's) WBS 2.3

Activity ID	Activity Description	FY05	FY06	FY07	FY08	FY09
3	Power supplies			3		



BTEV.FNAL.BD.TECH : Technician	0.0	0.0	0.8	0.8	0.0
BTEV.FNAL.BD.SRTECH : Senior Technician	0.0	0.0	0.1	0.3	0.0
BTEV.FNAL.BD.EE : Electrical Engineer	0.0	0.0	1.2	0.7	0.0

Schedule WBS 2.3

Activity ID	Activity Description	FY05	FY06	FY07	FY08	FY09
3	Power supplies			3		
3.1	10 KA supplies @ C0			3.1		
3.3	5 KA supplies for B4 & C1			3.3		
3.5	Q2 Shunts			3.5		
3.8	Corrector power supplies				3.8	

Risk Analysis WBS 2.3

- The Power Supply WBS technical risk is very small. We are proposing proven solutions to power supply needs of C0 IR.
- The power supply industry has several competitors in this area and a good competitive bid should be possible.
- Although this is the first time that the Fermi MI switcher has been used in the Tevatron and quench protection must be added, this also is a very safe approach.
- EE Support Department has a wealth of technical experts in the proposed technology areas.